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Title

Magneto-optical Recording or Reproducing Device

5 Field of the Invention

The invention relates to a magneto-optical recording or a magneto-optical reproducing device having an erasing facility for information recorded on a magneto-optical recording medium, it also being possible for such a recording or reproducing device to be used, for example, for the continuous magneto-optical recording, buffering and reproduction of video and/or audio signals.

15 Background of the Invention

Magneto-optical recording media and devices for recording and reproducing information stored on magneto-optical recording media are generally known. A known magneto-optical recording medium is the magneto-optical disc, which is also denoted as MOD or MO and in which there is arranged behind a transparent layer a magneto-optical layer on which information or data are stored and from which the stored information or data can be read. In order to store or write information or data onto a magneto-optical disc, the magneto-optical layer is heated by a laser beam, focused onto the disc, to a temperature in the region of the Curie or compensation temperature. Arranged behind the disc is an electromagnet which magnetizes the region heated by the laser beam in one direction of magnetization or the other. A magneto-optical writing device therefore comprises an optical scanning device which co-operates with an electromagnet and is denoted as a pick-up. After the laser beam is switched off, the heated site cools off again below the compensation temperature, and the direction of magnetization fixed by the electromagnet is maintained. It is, so as to say, frozen. In this case, one direction of magnetization

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corresponds to a logic one while the opposite direction of magnetization represents a logic zero.

The information or data are read using a principle which is based on the Kerr effect and on the fact that the plane of polarization of a linearly polarized light beam is rotated by an angle in the case of reflection at a magnetized mirror. The plane of polarization of the reflected light beam is rotated to the right or left in accordance with the direction of magnetization of the mirror. The rotation of the plane of polarization of the light beam reflected by the disc is detected by an optical scanning device, and a corresponding information or data signal is generated.

Provided for the purpose of magnetizing the magneto-optical layer is an electromagnet which can magnetize a region which is swept over by an optical scanning device. Magneto-optical recording devices are known in which information or data already stored on the recording medium must be erased before new information or data can be recorded. For this purpose, the magneto-optical layer is heated by the laser up to the Curie or compensation temperature at the sites at which the new information or data are to be stored, and magnetized in one direction. The plate is initialized. The laser power is switched between a small and a large value as a function of the bit to be stored so as to record the new information or data. For example, if a logic zero is stored at the previously erased site, the laser operates at the low power so that the Curie or compensation temperature is not reached. For the purpose of recording a logic one, by contrast, the laser heats the new site to be written on up to the Curie or compensation temperature so that said site can be remagnetized. By contrast with this, there are also already known magneto-optical recording devices in which already stored information or data are directly overwritten on the recording medium without firstly having to be

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5 erased. For the purpose of reliable remagnetization,
this method presupposes a high field strength which
must be changed over at high speed in order to record
new information or data. Since changing over high field
10 strengths at high speed leads in a known way to intense
heating of the electromagnet, the data rate up to which
this method can be applied is limited. A very high data
rate such as required, for example, to store a
television signal would lead to impermissible
15 overheating of the write head. In order to store new
information or data at a high data rate on a magneto-
optical recording medium already written onto, it is
therefore necessary for the stored information or data
to be erased in advance in accordance with the
20 abovenamed method. For this purpose, before recording
it is necessary to provide a time consuming erasing
pass, which can be carried out by the magneto-optical
writing device provided for recording information or
data. In order to permit information or data to be
25 recorded immediately, there is therefore a need for an
additional magneto-optical writing device which can
then be used to erase in advance information or data
already recorded on the magneto-optical recording
medium. The magneto-optical recording medium is then
initialized by the magneto-optical writing device, also
denoted as an erase pick-up.

Summary of the Invention

30 It is the object of the invention to create a magneto-
optical recording or reproducing device which permits
information or data recorded on a magneto-optical
recording medium to be overwritten with information or
data of a high data rate without a magneto-optical
writing device for erasing recorded information or
35 data, and which requires a low outlay.

This object is achieved by means of the
features specified in the main claim. Advantageous

embodiments and developments are specified in subclaims.

5 The invention proceeds from the finding that overwriting directly with a high data rate is rendered possible when there is arranged upstream of the magneto-optical writing device or upstream of the write head an erasing magnet which is, for example, a permanent magnet or electromagnet whose field strength is sufficient to initialize a region upstream of a track to be written without the assistance of a laser. It has been found that magneto-optical recording media can be initialized by a sufficiently strong magnetic field even without the assistance of a laser. This measure renders an erasing pass and an erase pick-up no longer necessary. Information or data already recorded on a magneto-optical disc are directly overwritten with the new information or data, which can also have a high data rate, without a previous erasing pass and a low outlay is required. Recording information or data onto the magneto-optical recording medium is then performed, for example, in a known way using a constant magnetic field and pulsed laser, and the erasing magnet has a magnetic field of opposite polarity to the magnet of the writing device.

25 With regard to the strength of its magnetic field, the erasing magnet is selected such that it erases the disc and/or the magneto-optical recording medium even without the assistance of a laser. In order, when returning to the start of the disc not to erase information or data already recorded and still to be reproduced in the case of a device for continuous recording, the erasing magnet is distanced from the disc, and thus deactivated, during the return, for example by means of an electromagnet or a mechanical device.

In the case of a magneto-optical recording and reproducing device for continuous recording and simultaneous or continuous reproduction of information

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or data, two optical scanning devices are then provided, of which one optical scanning device overwrites the magneto-optical recording medium in conjunction with a magnet, while the other respectively
5 continuously reproduces. The use of the erasing magnet dispenses with an optical scanning device for erasing information or data before the recording of new information or data onto the magneto-optical recording medium. The outlay for such a device is thereby
10 reduced.

Although the invention advantageously permits overwriting of information or data stored on magneto-optical recording media with information or data of a high data rate without a magneto-optical writing device
15 for erasing recorded information, it is not, however, limited to recording or reproducing information or data with a high data rate.

Brief Description of the Drawings

20 In an exemplary embodiment, the invention is explained in more detail with the aid of drawings, in which:

Figure 1 shows a sketch of the principle of a magneto-optical recording and reproducing device having an erasing facility for information or data recorded on a magneto-optical recording
25 medium, and

Figure 2 shows a sketch of the principle of a magneto-optical recording device having means for distancing the erasing facility.

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Detailed Description of the Preferred Embodiments

Reference symbols are used uniformly in the Figures. For the purpose of simplification, it is only elements of a magneto-optical recording and reproducing device
35 having an erasing facility for information or data recorded on a magneto-optical recording medium which are specified in the sketch of the principle, represented in Figure 1. However, by omitting

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appropriate modules the device can also be designed as a magneto-optical reproducing device having an erasing facility or as a magneto-optical recording device having an erasing facility. The magneto-optical recording and reproducing device represented in Figure 1 can advantageously be used both as a conventional recording and reproducing device and as a magneto-optical recording and reproducing device for continuous recording and reproduction. In accordance with this design, which can be used, for example, for monitoring purposes in banks or for time-shifted reproduction of television transmissions, a magneto-optical recording medium sectioned along its diameter is represented in perspective in Figure 1. By means of a write head, which comprises a writing magnet SM and a first optical scanning device OPU1, information or data are written onto the magneto-optical recording medium inserted into the device. The writing magnet SM and the first optical scanning device OPU1 are arranged, in accordance with Figure 1, in a fashion mechanically connected to one another and opposite one another, while the magneto-optical recording medium is located between them.

Since recordings are made on magneto-optical recording media in a track from the inside to the outside, new information or data are recorded in a first region NR of the magneto-optical recording medium in accordance with Figure 1. The write head is, for example, designed by analogy with known write heads. Also provided in accordance with Figure 1 is an erasing facility which is formed in accordance with the invention exclusively by an erasing magnet LM and is arranged upstream of the write head in the scanning direction of the magneto-optical recording medium. The erasing magnet LM is used to initialise the magneto-optical recording medium directly before the recording of new information or data. The result is to produce on the magneto-optical recording medium upstream of the writing magnet SM a second region AE in which

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information or data previously stored on the magneto-optical recording medium are erased. The initialization of the magneto-optical recording medium before the recording of new information or data renders it possible, in particular, for regions of the magneto-optical recording medium already written on earlier to be recorded and/or overwritten with a high data rate such as is required, for example, to record video signals.

10 The erasing magnet LM is provided in Figure 1 as a so-called permanent magnet which is arranged next to the writing magnet SM on the same side relative to the magneto-optical recording medium, and has a direction of magnetization opposite to the writing magnet SM. In addition, both the writing magnet SM and the erasing magnet LM can optionally also be designed as electromagnets. It is to be seen that the erasing facility consists only of an erasing magnet LM, and that no optical scanning device assigned to the erasing magnet LM is provided. No laser which heats the magneto-optical recording medium is provided for erasing stored information or data. In order, nevertheless, to achieve erasure of information or data already stored on a magneto-optical recording medium, and/or to initialize the magneto-optical recording medium, provision is made of an erasing magnet LM with a field strength sufficient to erase and/or initialize the magneto-optical recording medium. The field strength of the erasing magnet LM, which is greater by comparison with the field strength of the writing magnet SM, is used to erase information or data stored on the magneto-optical recording medium and to initialize the magneto-optical recording medium even without the assistance of a laser. This comparatively greater field strength of the erasing magnet LM leads, if appropriate, to the fact that, in accordance with the Figure, a plurality of tracks of the magneto-optical recording medium are simultaneously erased

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In accordance with Figure 1, the erasing magnet LM is preferably mechanically connected to the write head, and is thereby guided over the magneto-optical recording medium in advance of the write head in the normal write or read direction of the magneto-optical recording medium. In the case of an optical scanning device OPU1 comprising coarse and fine drives, the mechanical connection between the writing magnet SM and the erasing magnet LM is provided in such a way that the writing magnet SM and the erasing magnet LM are connected to the coarse drive of the optical scanning device OPU1, or follow of the coarse drive. In an embodiment according to Figure 1 which uses permanent magnets and laser modulation as the selected writing method, only slight requirements are placed on the quality and/or accuracy of the positioning and tracking of the writing magnet SM and the erasing magnet LM. It is sufficient to connect the writing magnet SM and erasing magnet LM to the optical scanning device OPU1 in a fashion corresponding to a metal or plastic angle which is produced with moderate precision. In an embodiment in accordance with Figure 1, a means is to be provided for deactivating the erasing magnet LM, in order not to erase recorded information or data during a jump into the inner region of the magneto-optical recording medium. For this purpose, the connection between the erasing magnet LM and the writing device is, if appropriate, to be provided, in accordance with

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A recording and reproducing device according to Figure 1 for continuously recording and reproducing information or data has a second optical scanning device OPU2 for reading the recorded information or data. However, a second optical scanning device OPU2 is required only if, for example, it is intended to reproduce a radio or television transmission while simultaneously recording a radio or television transmission, in order to enable a time-shifted reproduction, for example. After the reproduction of information or data which are recorded, in accordance with Figure 1, in a fourth region LR on the magneto-optical recording medium, the reading device and/or second optical scanning device OPU2 reaches the outer region of the magneto-optical recording medium. To continue the reproduction, the second optical scanning device OPU2 consequently jumps into the interior or first region NR of the magneto-optical recording medium, in which new information or data are recorded. In Figure 1, this jump is specified by an optical scanning device OPU2 represented by dashed lines. In the case of a device for simultaneously recording and reproducing information or data, provision is then made of a first optical scanning device OPU1 for overwriting and a second optical scanning device OPU2 for reproduction, without the need for a third optical scanning device for erasing. The use of the permanent

magnet for erasing renders superfluous the use of a third optical scanning device which would be used to carry out erasure before the recording.

However, the second optical scanning device

5 OPU2, provided exclusively for reading the magneto-optical recording medium, and/or the reading device of the magneto-optical recording medium can also be used in a known way for optionally accessing information or data on the magneto-optical recording medium. A

10 connection to a so-called live transmission is then achieved, for example, by jumping over recording regions. In the case of a reproducing device having an erasing facility, it is possible in accordance with a selected embodiment to provide a separate drive for the

15 erasing magnet LM or the erasing magnet LM can be connected to the second optical scanning device.

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